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APPENDIX D: DEADWEIGHT SURVEY - MV LIGHTNING

LIGHTSHIP SURVEY REPORT

Vessel:	25m Catamaran Ferry	Client:	MBTA
Reference:	IC20051-R-828 (Lightship Report)	Revision:	B
Date:	11-May-20	Rev Date:	14-May-20
Prepared:	AVK	Checked:	CG
Yard Ref:	N/A	Survey Ref:	C-933

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Technical Provisions No. RROPS20-01

Lightship Survey

Particulars

Item	Value	Units
Vessel	MV Lightning	
Date	5/5/2020	
Location	N/A	
Wind	N/A	
Sea	N/A	
People Present	JFM	
Water Specific Gravity	1.0225	t/m ³

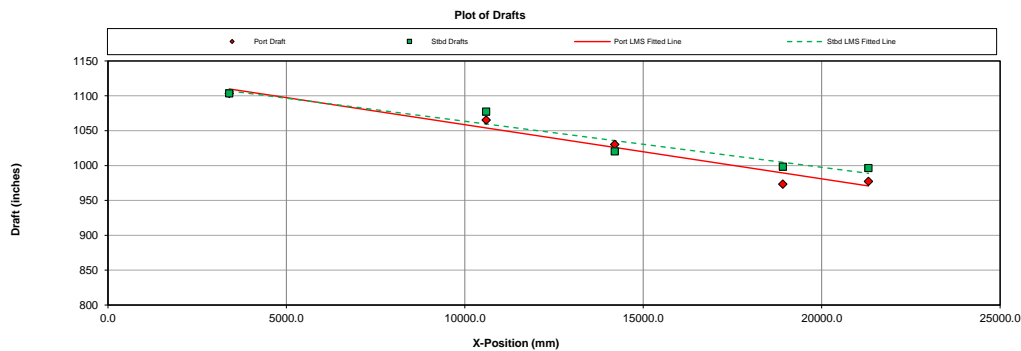
To determine an average 'fitted' curve, the 'least mean square' trend line has been determined. The port and starboard values of the least mean squared waterline were then averaged, to obtain the freeboard values which are used to determine the measured lightship weight and LCG.

Drafts

Long. Location (mm)	Molded Depth (mm)	Bulwark Height (mm)	Deck Thickness (mm)	Measured Freeboard		Average Freeboard (mm)
				Port (mm)	Stbd (mm)	
3400.0	2722.4	0	0.00	1619	1619	1619
10600.0	2722.4	0	0.00	1657	1645	1651
14200.0	2722.4	0	0.00	1692	1702	1697
18910.0	2722.4	0	0.00	1749	1724	1737
21310.0	2952.4	0	0.00	1975	1956	1966

Long. Location (mm)	Measured Draft		LMS Draft		Average Draft (mm)	Heel (degrees)
	Port (mm)	Stbd (mm)	Port (mm)	Stbd (mm)		
3400.0	1103	1103	1110	1107	1108	-0.02
10600.0	1065	1077	1054	1060	1057	0.04
14200.0	1030	1020	1026	1036	1031	0.07
18910.0	973	998	989	1005	997	0.10
21310.0	977	996	971	989	980	0.12

Hydrostatics Position	Long. Location (mm)	Calculated Draft (mm)
Draft at Aft Perpendicular	0	1133
Draft at Fwd Perpendicular	23480	964



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Measured Condition

Parameter	Value
Draft Amidsh. m	1.049
Displacement kg	52101
Heel to Starboard degrees	0.1
Draft at forward perpendicular	0.964
Draft at aft perpendicular	1.133
Draft at LCF m	1.062
Trim (+ve by stern) m	0.169
WL Length m	23.079
WL Beam m	8.31
Wetted Area m ²	139.664
Waterpl. Area m ²	84.641
Prismatic Coeff.	0.745
Block Coeff.	0.438
Midship Area Coeff.	0.64
Waterpl. Area Coeff.	0.83

Parameter	Value
LCB from zero pt. m	9.701
LCF from zero pt. m	9.82
KB m	0.729
KG fluid m	3.553
BMT m	16.035
BML m	57.25
GMT m	13.281
GML m	54.496
KMT m	16.764
KML m	57.977
Immersion (TPc) tonne/cm	0.865
MTc tonne.m	1.209
RM at 1deg = GMT.Disp.sin(1) kg.m	12076.199
Max deck inclination deg	0.417
Trim angle (+ve by stern) deg	0.4124

Longitudinal CG Correction

Parameter	Value	Units
Trim	0.169	m
MTc	1.209	Tonne.m/cm
MTc (level trim at same Disp)	1.246	Tonne.m/cm
Avg of MTC's	1.228	Tonne.m/cm
Avg Trimming Moment	20.745	T.m
Avg Trimming Lever	0.398	m
LCB (level trim at same Disp)	10.119	m
LCG (LCB - Trimming Lever)	9.721	m
Righting moment (trans.)	741.665	kg.m
TCG	0.014	m

Notes

All longitudinal positions are taken from Frame 0
 All transverse positions are taken from vessel centreline
 All vertical positions are taken from baseline

Removable/Additional Masses

Fluids Off	Weight (kg)	LCG (m)	VCG (m)	TCG (m)	LMOM (kg m)	VMOM (kg m)	TMOM (kg m)
F.O. Tank (P)	2240.0	11.515	1.400	-3.050	25793.6	3136.0	-6832.0
Potable Water Tank (P)	380.0	4.088	1.720	-3.050	1553.4	653.6	-1159.0
F.O. Tank (S)	707.7	11.515	1.079	3.050	8149.2	763.5	2158.5
Total Fluids Off	3327.7	10.667	1.368	-1.753	35496.2	4553.1	-5832.5

Dry Items Off	Weight (kg)	LCG (m)	VCG (m)	TCG (m)	LMOM (kg m)	VMOM (kg m)	TMOM (kg m)
Beverages	22.7	3.962	3.364	0.000	89.9	76.4	0.0
Misc.	11.3	3.962	3.973	0.000	44.8	44.9	0.0
Misc.	4.5	4.267	2.754	0.000	19.2	12.4	0.0
Beverages	27.2	7.010	3.668	0.000	190.7	99.8	0.0
Personal Items	4.5	9.144	3.668	0.000	41.1	16.5	0.0
Equipment	13.6	6.401	3.059	0.000	87.1	41.6	0.0
Equipment	22.7	18.593	3.668	0.914	422.1	83.3	20.7
Equipment	13.6	18.593	3.668	-0.914	252.9	49.9	-12.4
Misc.	9.1	16.154	5.639	0.000	147.0	51.3	0.0
ER Equipment	4.5	14.021	0.914	0.000	63.1	4.1	0.0
ER Equipment	2.3	14.021	0.914	0.000	32.2	2.1	0.0
Dry Items Off	136.0	10.221	3.546	0.061	1390.1	482.3	8.3

Dry Items On	Weight (kg)	LCG (m)	VCG (m)	TCG (m)	LMOM (kg m)	VMOM (kg m)	TMOM (kg m)
	0.0	0.000	0.000	0.000	0.0	0.0	0.0
Dry Items On	0.0	0.000	0.000	0.000	0.0	0.0	0.0

Adjusted Lightship LCG

Item	Weight (kg)	LCG (m)	VCG (m)	TCG (m)	LMOM (kg m)	VMOM (kg m)	TMOM (kg m)
Measured Condition	52101.0	9.721	n/a	0.014	506465.3	0.0	741.7
Fluids Off	3327.7	10.667	1.368	-1.753	35496.2	4553.1	-5832.5
Dry Items Off	136.0	10.221	3.546	0.061	1390.1	482.3	8.3
Dry Items On	0.0	0.000	0.000	0.000	0.0	0.0	0.0
Measured Lightship	48637.3	9.655	n/a	0.135	469579.0	-5035.3	6565.9

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Measured and Calculated Lightship Comparison

Item	Weight (kg)/(%)	LCG (m)/(%)	LMOM (kg.m)/(%)	VCG (m)/(%)	VMOM (kg.m)/(%)	TCG (m)/(%)	TMOM (kg.m)/(%)
Measured Lightship	48637	9.655	469579	n/a	0	0.135	6566
MV Flying Cloud Lightship	46110	9.850	454184	3.230	148935	0.000	0
Difference	2527	-0.195	-494	n/a	n/a	n/a	n/a
Difference to MV Flying Cloud	5.481%	-1.983%					

Final Lightship Values (For Stability Calculations)

Item	Value	Units	Value	Units
Mass	48637	kg	47.869	LT
LCG	9.655	m	31.676	ft
VCG (+10% margin)	3.553	m	11.657	ft
TCG	0.135	m	0.443	ft